Claims

[c1] 1.A pulsed power application system for an x-ray tube comprising:
an x-ray tube having an anode and cathode;
a power supply configured to provide optical energy and an anode-to-cathode gap voltage via electrical energy, wherein said optical energy and said gap voltage are pulsed resulting in a pulsed x-ray radiation; and
a means for transferring said optical energy and said electrical energy from said power supply to said x-ray tube.

[c2] 2.The pulsed power application system of claim 1, wherein said optical energy and said gap voltage is pulsed by pulsing the extraction voltage of said power supply.

[c3] 3.The pulsed power application system of claim 1, wherein the x-ray tube is bipolar and said anode is connected to a positive terminal of a first power supply and said cathode is connected to a negative terminal of a second power supply, remaining terminals of said first and second power supply are referenced to ground.

[c4] 4.The pulsed power application system of claim 1, wherein said anode is referenced to ground potential and said cathode is connected to a negative terminal of a second power supply.

[c5] 5.The pulsed power application system of claim 1, wherein said optical energy is generated by one of a laser, an LED, and an electroluminescent device in operable communication with said power supply and configured to generate pulsed photon energy at a suitable wavelength to optimize electron emission from an electron source.

[c6] 6.The pulsed power application system of claim 1, wherein said cathode includes a surface configured as an electron source to generate electrons triggered by photons directed at said surface, said photons generated from said optical energy.

[c7] 7.The pulsed power application system of claim 6, wherein said surface of said cathode is a photo-emitting surface including at least one of clean metals,

semi-conductor crystals, coated metal materials, coated oxide materials, and cleaved crystal edges.

[c8] 8.The pulsed power application system of claim 7, wherein said electron source includes a field emission array (FEA).

[c9] 9.The pulsed power application system of claim 8, wherein said field emission array (FEA) includes a Spindt-type field emission array.

[c10] 10.The pulsed power application system of claim 1, wherein said means for transferring said optical energy and said electrical energy from said power supply to said x-ray tube is a single cable, said single cable comprising:
a waveguide configured to transfer optical energy to the x-ray tube,
an electrical conductor configured to transfer electrical energy to the x-ray tube, said electrical conductor surrounding at least a portion of said waveguide along a length of the cable; and
an insulation material disposed between said waveguide and said electrical conductor, said insulation material surrounding said waveguide and said electrical conductor.

[c11] 11.An x-ray tube adapted to generate pulsed x-ray radiation comprising:
a frame;
an anode disposed in said frame;
a cathode corresponding with said anode disposed in said frame;
a power supply configured to provide optical energy and an anode-to-cathode gap voltage via electrical energy, wherein said optical energy and said gap voltage are pulsed resulting in a pulsed x-ray radiation; and
a means for transferring said optical energy and said electrical energy from said power supply to said x-ray tube.

[c12] 12.The x-ray tube of claim 11, wherein said optical energy and said gap voltage is pulsed by pulsing the extraction voltage of said power supply.

[c13] 13.The x-ray tube of claim 11, wherein said power supply includes a positive terminal in electrical communication with said anode and a negative terminal in electrical communication with said cathode, wherein said power supply

generates a pulsed emission current resulting in the pulsed x-ray radiation from said anode.

[c14] 14.The x-ray tube of claim 11, wherein the x-ray tube is bipolar and said anode is connected to a positive terminal of a first power supply and said cathode is connected to a negative terminal of a second power supply, remaining terminals of said first and second power supply are referenced to ground.

[c15] 15.The x-ray tube of claim 11, wherein said optical energy is generated by one of a laser, an LED, and an electroluminescent device in operable communication with said power supply and configured to generate pulsed photon energy at a suitable wavelength to optimize electron emission from an electron source.

[c16] 16.The x-ray tube of claim 11, wherein said cathode includes a surface configured as an electron source to generate electrons triggered by photons directed at said surface, said photons generated from said optical energy.

[c17] 17.The x-ray tube of claim 16, wherein said surface of said cathode is a prepared photo-emitting surface including at least one of clean metals, semi-conductor crystals, coated metal materials, coated oxide materials, and cleaved crystal edges.

[c18] 18.The x-ray tube of claim 17, wherein said electron source includes a field emission array (FEA).

[c19] 19.The x-ray tube of claim 18, wherein said field emission array (FEA) includes a Spindt-type field emission array.

[c20]

20.The pulsed power application system of claim 11, wherein said means for transferring said optical energy and said electrical energy from said power supply to said x-ray tube is a single cable, said single cable comprising:
a waveguide configured to transfer optical energy to the x-ray tube,
an electrical conductor configured to transfer electrical energy to the x-ray tube, said electrical conductor surrounding at least a portion of said waveguide along a length of the cable; and
an insulation material disposed between said waveguide and said electrical

conductor, said insulation material surrounding said waveguide and said electrical conductor.

[c21] 21.A method to reduce the size for improving the efficiency of operation in x-ray tubes, the method comprising:
configuring a power supply to provide optical energy and electrical energy;
connecting said power supply to the x-ray tube with a means for transferring said optical energy and said electrical energy from said power supply to the x-ray tube, the x-ray tube having an anode and a cathode disposed in the x-ray tube to provide a gap voltage therebetween;
pulsing said gap voltage; and
generating a pulsed x-ray radiation from said anode.

[c22] 22.The method of claim 21, wherein wherein said means for transferring said optical energy and said electrical energy from said power supply to said x-ray tube is a single cable, said single cable comprising:
a waveguide configured to transfer optical energy to the x-ray tube,
an electrical conductor configured to transfer electrical energy to the x-ray tube, said electrical conductor surrounding at least a portion of said waveguide along a length of the cable; and
an insulation material disposed between said waveguide and said electrical conductor, said insulation material surrounding said waveguide and said electrical conductor.

[c23] 23.A pulsed power application system for an x-ray tube comprising:
an x-ray tube having an anode and cathode;
a power supply configured to provide optical energy generating photons and electrical energy generating an anode-to-cathode gap voltage; and
a pulsing means for pulsing said photons and said gap voltage resulting in a pulsed x-ray radiation;
a means for transferring said optical energy and said electrical energy from said power supply to said x-ray tube.

[c24] 24.The pulsed power application system of claim 23 wherein said pulsing means includes at least one of, and includes combinations of at least one of:

pulsing the extraction voltage of said power supply;
applying a grid voltage to control electron emission current; and
switching one of a switchable electron source in operable communication with the cathode.

[c25] 25.A power supply cable for an x-ray tube comprising:
a waveguide configured to transfer optical energy to the x-ray tube;
an electrical conductor configured to transfer electrical energy to the x-ray tube, said electrical conductor surrounding at least a portion of said waveguide along a length of the cable; and
an insulation material disposed between said waveguide and said electrical conductor, said insulation material surrounding said waveguide and said electrical conductor.

[c26] 26.The cable of claim 25, wherein said electrical conductor includes two electrical conductors surrounding said at least a portion of said waveguide, said two electrical conductors configured to optimize a skin effect for pulsed power current transmission through said two electrical conductors.

[c27] 27.The cable of claim 26, wherein each of said two electrical conductors is configured as a portion of a cylindrical wall disposed proximate a periphery of the cable to optimize said skin effect.

[c28] 28.The cable of claim 25, wherein said electrical conductor is configured to use a transmission line effect of a pulse train of power to maximize voltage at the x-ray tube.

[c29] 29.The cable of claim 25, wherein said waveguide includes one of an optical fiber and a bundle of optical fibers.

[c30] 30.The cable of claim 25, wherein said waveguide is made from one of a plastic and a glass.

[c31] 31.A method to reduce the size of a power cable supplying an x-ray tube, the method comprising:
employing an optical waveguide to transfer optical energy to an electron source

triggered by photon energy to initiate release of electrons;
configuring an accelerating potential conductor taking into account skin effect to reduce the thickness thereof and circumferentially disposing about said waveguide; and
disposing an insulating material between said conductor and said waveguide, said insulation material surrounding said conductor and a periphery of said waveguide.